



A remarkable new genus of Dikraneurini (Hemiptera: Cicadomorpha: Cicadellidae: Typhlocybinae) from Southeast Asia

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Abstract

Sweta **gen. n.** is described and illustrated based on type species *S. hallucinata* **sp. n.** from northeast India and Thailand and placed in the typhlocybinae tribe Dikraneurini. The new genus is unique among known Typhlocybinae in having the pronotum enlarged and extended to the scutellar suture. This feature is characteristic of the related subfamily Signoretinae, but among other subfamilies is restricted to a few brachypterous forms.

Key words: Homoptera, leafhopper, morphology, distribution

Introduction

Microleafhoppers of the tribe Dikraneurini are small, delicate, often colorful insects that occur in a wide variety of habitats ranging from lowland tropical rainforest to cool temperate grassland. Morphologically, dikraneurines differ from other members of subfamily Typhlocybinae in having the hind wing submarginal vein complete and veins RP and MA confluent distally. The type genus, *Dikraneura* Hardy, is widespread in the Holarctic region and associated mostly with grasslands where species are recorded from a wide variety of grasses and herbaceous dicots (Knight 1968). From an ecological perspective, *Dikraneura* appears to be atypical of Dikraneurini as a whole because most other described dikraneurines occur in forests and apparently feed on woody hosts. Although relatively few species have been described from the tropics, the rainforest canopy of lowland Amazonia apparently harbors a large and almost completely undescribed fauna (Dietrich and Wallner 2002). More dikraneurine species have been described from the Old World tropics, but the fauna there also remains poorly known.

The new dikraneurine genus described herein from northeast India and Thailand is remarkable because it shares features with another leafhopper subfamily, Signoretinae, restricted to the Old World tropics (see Discussion). This new genus, based on a single new species, is described below.

Material and methods

Morphological terminology follows Dietrich (2005). Specimens examined are deposited in the Natural History Museum, London (BMNH), Illinois Natural History Survey, Champaign, Illinois, USA (INHS), and Queen Sirikit Botanical Garden, Chiang Mai, Thailand (QSBG).

Typhlocybinae: Dikraneurini

Sweta **gen. n.**

Type species: *Sweta hallucinata* **sp. n.**

Head (Figs. 1–3) narrower than pronotum, short and broad, of uniform length throughout, strongly elevated above level of pronotum. Ocelli absent, vestiges present as paired pits on face well ventrad of crown margin, closer to eyes than to each other. Face longer than broad, in profile rather convex, weakly depressed. Clypellus broad at base, projecting beyond margin of gena, broader and more convex in male than in female. Frontal sutures reaching ocellar pits. Rostrum tapered, extended to middle coxae. Pronotum (Figs. 1–2) widened posteriorly, densely but finely punctate, extending beyond anterior margin of eyes anteriorly and to scutellar suture posteriorly, 1.2 times as wide as long, disc strongly convex with slight median posterior emargination; distinct submarginal furrow present along anterior and lateral margins; lateral margins long, carinate. Forewing (Fig. 4) widened gradually toward apex, widest at 0.66 length, without closed anteapical cells, R with two branches originating slightly distad of mid-length, posterior branch strongly curved and sinuate toward apex; M with anterior branch strongly sinuate distally; inner apical cell narrow, elongate, gradually tapered; clavus with one indistinct vein; appendix absent. Hind wing (Fig. 5) with submarginal vein complete but weakly developed along costal margin; veins RP and MA confluent distally; CuA and MP completely confluent (CuA appearing unbranched); anal vein not forked. Front femur with dorsoapical pair of macrosetae; AM1 large, on ventral margin; intercalary row with 4 large basal setae and 7 smaller setae more distad; tibia row AV with 8 macrosetae. Middle femur with only PD1 developed; tibia without preapical macrosetae. Hind femur macrosetae 2+1; tibial chaetotaxy PD: 10–12, AD: 8–11, AV: 4, PV: ~28, PV setae capitate except 3 larger, tapered setae near apex; hind basitarsus (Fig. 6) as long as tarsomeres II and III combined, with dorsoapical pair of macrosetae and single enlarged ventromedial seta, acutely pointed distally, lacking apical transverse row of spines and platellae.

Male abdomen (Fig. 7) with apodemes of sternum III well developed. Pygofer (Fig. 8) with tergum long and well sclerotized, lobes short, irregularly rounded distally, with short, fine setae distributed sparsely over distal half, appendages absent. Tergum X (Fig. 8) massive, well sclerotized, extended ventrolaterad into pair of acuminate processes. Valve (Figs. 8–9) quadrate, articulated to pygofer. Subgenital plate (Figs. 8–9) depressed in basal half, compressed distally, triangular in ventral view, with 3–4 macrosetae in oblique row near midlength and small, fine setae scattered over distal half. Style (Fig. 12) slender throughout length, apodeme short, apophysis elongate and nearly straight, preapical lobe poorly developed, apex hooked dorsad and acuminate, with preapical heel, shaft of apophysis with few sensilla and single seta preapically. Connective (Fig. 11) not present as distinct sclerite, apparently fused to aedeagus and transverse. Aedeagus (Figs. 10–11) symmetrical, dorsal apodeme weakly developed, preatrium short, shaft compressed, with paired subapical processes, gonopore preapical on posteroventral surface.

Female ovipositor with first valvula sculpturing strigate (Figs. 14–15), striae reaching dorsal margin, arranged in three tiers distally. Second valvulae (Figs. 16–19) strongly curved but not sigmoid distally, moderately broad throughout, with troughlike excavation at base of toothed distal blades; right and left second valvulae asymmetrical, teeth larger with secondary dentition on right valvula (Fig. 17) compared to weaker teeth lacking secondary dentition on left valvula (Fig. 19); additional row of teeth present submarginally, closer to dorsal margin on left valvula compared to those on right valvula.

Remarks. *Sweta* is easily distinguishable from all other known Typhlocybae in having the pronotum enlarged, strongly convex, and extended to the scutellar suture, and the crown of the head strongly elevated above the anterior margin of the pronotum. Its small size and broad, tectiform forewing with elongate, sinuate distal segments of veins R and M, give the new genus a superficial resemblance to Psyllidae. Among other known macropterous leafhoppers, only Signoretiinae (=Phlogisinae, Dietrich 2005) have the pronotum extended to the scutellar suture. *Sweta* differs from Signoretiinae in several important respects (see Discussion below).

The female genitalia of Typhlocybae have not been studied comprehensively; thus, the significance of the characters described above for the ovipositor of *Sweta* is unknown. A recent comparative study of species of European Empoascini indicates that *Sweta* has an ovipositor very similar to that of *Empoasca pteridis* (Dahlbom) (see Demichelis *et al.* 2010: Figs. 2D, 3D).

The new species upon which the genus is based appears to be widespread but very rare. The three specimens from Thailand were found only after a search of >3,000 Malaise trap samples containing >500,000 specimens, and only one other specimen, a female from northeastern India, has been found in museum collections.

The genus name is derived from the Sanskrit *sweta*, meaning “white”, and refers to predominantly white color of the insect and is to be treated as feminine noun.

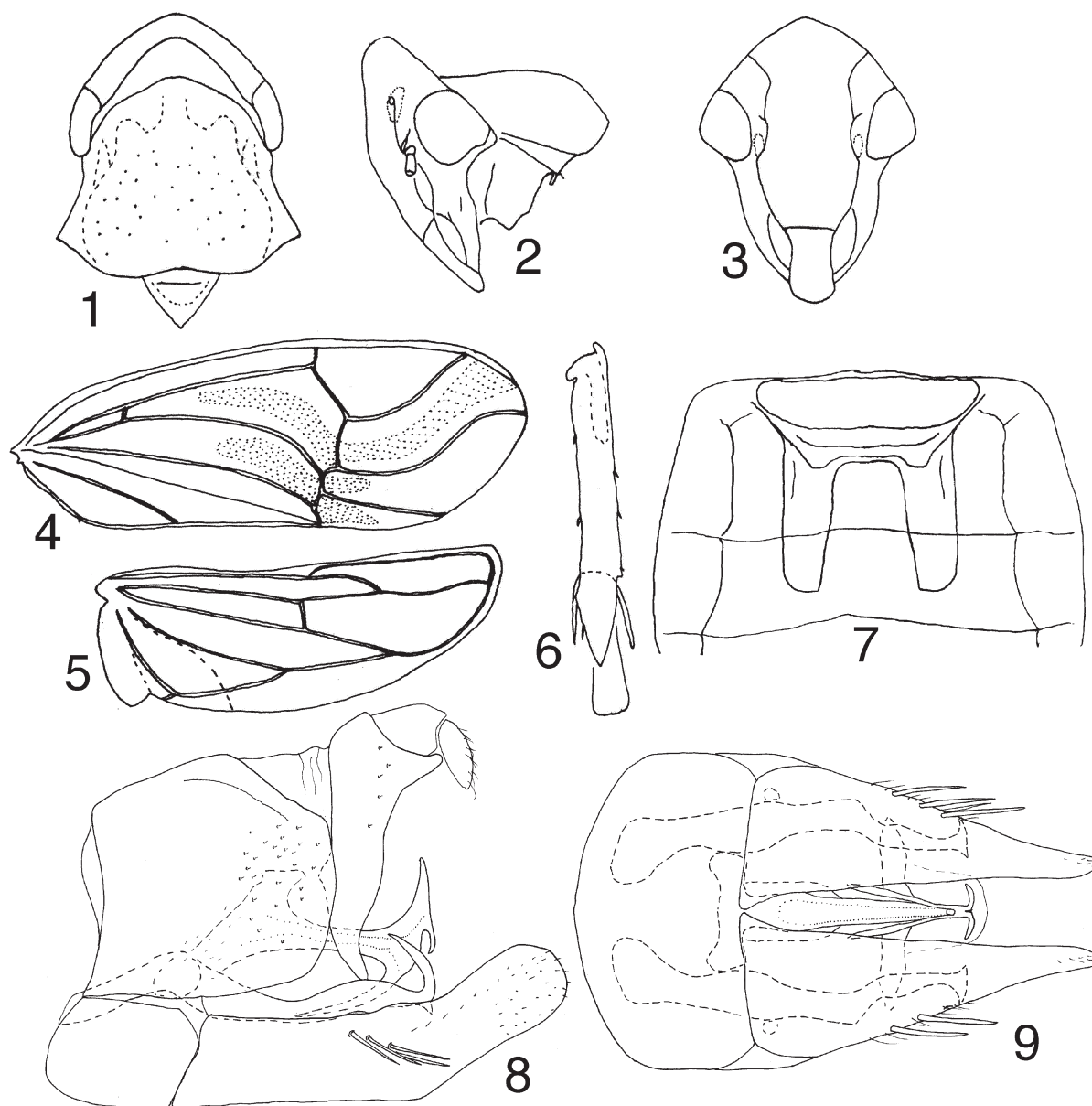
***Sweta hallucinata* sp. nov.**

Figs. 1–21

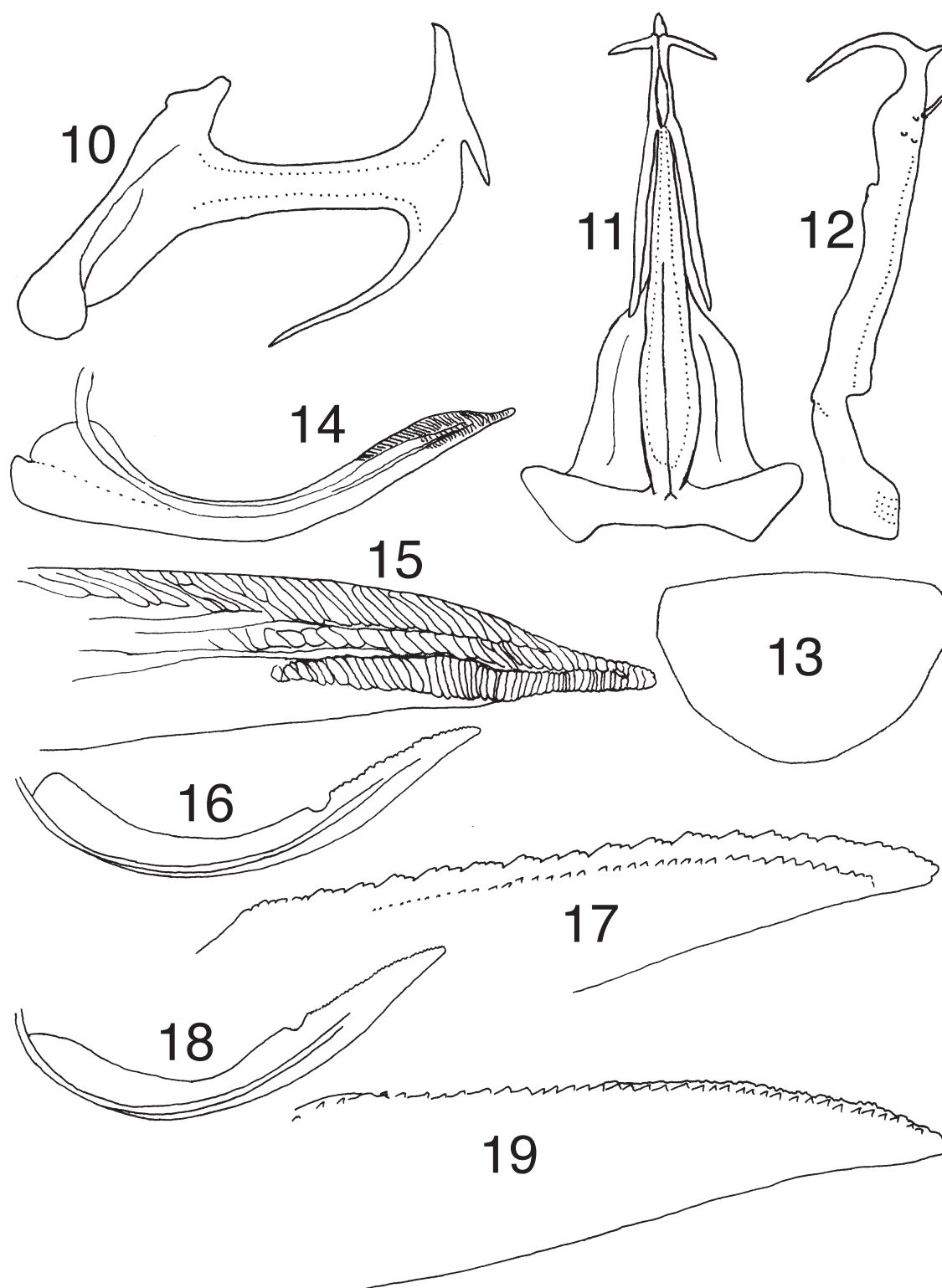
Milky white to pale yellow. Forewing cells rather clouded with faint pale brown; distal portions of tarsi dark brown (Fig. 19). Male abdomen with 3S apodemes slightly divergent, extended to midlength of segment IV (Fig. 7); aedeagus with ventral preapical processes gradually recurved in lateral view (Fig. 10), straight and slightly divergent from shaft in ventral view (Fig. 11); distal processes extended posteroventrad in lateral view; extended laterad and slightly basad in ventral view; shaft apex abruptly and obliquely tapered in lateral view. Other features as in generic diagnosis.

Female genitalia. Seventh sternite (Fig. 13) broadly roundly produced caudally.

Measurements. Male 3.5–3.8 mm long, 0.75 mm wide across eyes, 0.8 mm wide across hind margin of pronotum. Female 3.8–3.9 mm long, 0.8 mm wide across eyes, 0.9 mm wide across hind margin of pronotum.



FIGURES 1–9. *Sweta hallucinata*, sp. n.: 1, head, pronotum, and scutellum, dorsal view; 2, head and prothorax, lateral view; 3, head anterior view; 4, forewing; 5, hind wing; 6, hind tarsomeres I and II, ventral view; 7, base of abdomen, ventral view; 8, male genital capsule, lateral view; 9, same, ventral view.



FIGURES 10–19. *Sweta hallucinata*: 10, aedeagus, lateral view; 11, same, posteroventral view; 12, style, ventrolateral view; 13, female abdominal sternite VII; 14, first valvula, lateral view; 15, detail of same; 16, right second valvula; 17, detail of same; 18, left second valvula; 19, detail of same.

Material examined. Holotype ♂ THAILAND: Phetchabun, Khao Kho NP, mixed deciduous forest at Ta Phol river, 16°32.546'N101°2.501'E, 274m, Malaise trap 5–12.xi.2006, Somchai Chachumnan & Saink Singhtong T970 (QSBG). Paratypes: 1 ♀ THAILAND: Lampang, Chae Son NP behind visitor center 18°50.075'N 99°28.433'E

421m, Malaise trap 1–8.ix.2007, Bunruen Kwunnui & Acharaporn Sukpeng T2832 (QSBG); 1 ♂ THAILAND Lampang, Chae Son NP Huay Yen 18°49.924'N 99°28.652'E 419m, Malaise trap 1–7.xi.2007, Bunruen Kwunnui & Acharaporn Sukpeng T2837 (INHS); 1 ♀, INDIA: Mizoram: Aizawl, 18.xi.1981, C.S.W. Wesley (BMNH).



FIGURES 20–21. *Sweta hallucinata*, lateral and dorsal habitus, paratype female from Mizoram.

Etymology. The species name is derived from the Latin *hallucinator*, meaning “dream” and refers to the unusual and remarkable appearance of the new species.

Discussion. Discovery of the new genus described above is important because it provides further evidence of a relationship between the leafhopper subfamilies Typhlocybinae and Signoretiinae.

Signoretiinae is a small, poorly known subfamily of leafhoppers, apparently restricted to the Old World tropics. The group was previously uniquely defined within Cicadellidae based on the enlarged pronotum that extends to the scutellar suture. Other leafhoppers, with the exception of a few groups with reduced wings, have the pronotum relatively short, such that part of the mesonotum anterad of the scutellar suture is exposed.

A morphology-based phylogenetic analysis of Cicadellidae (Dietrich 1999) placed Signoretiinae in a clade together with Cicadellinae (*sensu stricto*), Evacanthinae, Mileewinae and Typhlocybinae and a recent, more detailed analysis of this lineage (Dietrich 2004) placed *Signoretia* Stål as sister to a clade comprising Typhlocybinae + (Mileewinae + Tinterominae).

Signoretiinae has mixed morphological affinities to these taxa. It is similar to most Cicadellinae *sensu lato* in having the frontoclypeus inflated (an indication of xylem feeding), the ocelli on the crown, and the female second valvulae with the toothed section occupying more than half its length, but resembles Evacanthinae (tribe Evacanthini) in having a complete median longitudinal carina on the frontoclypeus and the ocelli in submarginal depressions on the crown. Similarities to Typhlocybinae and Mileewinae include the reduced forewing venation (R two-

branched and crossveins r-m1 and m-cu2 absent), the tapered first hind tarsomere, and the strongly curved ovipositor.

Although *Sweta* resembles *Signoretia* in having the pronotum enlarged and the forewing veins sinuate distally, the new genus is clearly referable to Typhlocybinae based on its small size, vestigial ocelli, absence of closed preapical cells in the forewing, acuminate first hind tarsomere, and asymmetrical female second valvulae. Table 1 provides a comparison of *Sweta*, the apparently related dikraneurine genus *Anaka* Dworakowska & Viraktamath, and *Signoretia* Stål, indicating that although the *Sweta* and Signoretiinae share one putative synapomorphy that does not occur in other Typhlocybinae--the enlarged pronotum--it shares many more synapomorphies with Typhlocybinae that do not occur in *Signoretia*. A detailed phylogenetic analysis will be needed to further elucidate the relationship between Signoretiinae and Typhlocybinae in light of the discovery of *Sweta*, which is morphologically intermediate between these two subfamilies.

TABLE 1. Morphological comparison of *Sweta* to the apparently related genus *Anaka* (Dikraneurini) and *Signoretia* (Signoretiinae). Probable synapomorphies shared by *Sweta* with other Dikraneurini (and other Typhlocybinae) are indicated by *; synapomorphies of Signoretiinae are indicated by ^.

	<i>Sweta</i>	<i>Anaka</i>	<i>Signoretia</i>
Ocelli development	Vestigial*	Vestigial	Well developed
Ocelli/vestige position	On face	On face	On crown margin
Frontoclypeus median carina	Absent	Absent	Present^
Frontoclypeus form	Weakly convex*	Weakly convex	Strongly inflated
Pronotum	Reaching scutellum^	Not reaching scutellum	Reaching scutellum^
Pronotal texture	Finely punctate	Glabrous	Coarsely punctate^
Forewing crossvein s	Absent*	Absent	Present
Forewing appendix	Absent*	Absent	Present
Hind wing veins RP and MA	Confluent*	Confluent	Separate
Hind wing anal vein	Unbranched*	Unbranched	Branched
Mesepisternum	United*	United	Divided by suture
Hind femur macrosetae	2+1	2+1+1	2+0^
Hind tarsomere I apex	Acuminate*	Acuminate	Tapered but short
Hind tarsomere apical platellae	Absent*	Absent	1–2 present
Male connective and aedeagus	Fused	Fused	Separate
Second valvulae symmetry	Asymmetrical*	Asymmetrical	Symmetrical

Sweta may be placed with confidence in Typhlocybinae based on its acuminate first hind tarsomere and in the typhlocybinae tribe Dikraneurini based on its long, subparallel sided forewing inner apical cell, and hind wing with the submarginal vein complete and veins RP and MA confluent. Other features consistent with Dikraneurini are the vestigial ocelli and the triangular male subgenital plate with few lateral macrosetae. The absence of pygofer processes and presence of ventrolateral processes on segment X are unusual among dikraneurines; the latter feature also occurs in the Indomalayan dikraneurine genus *Golwala* Dworakowska but is more common in the typhlocybinae tribe Empoascini. The slender style with footlike apex is also unusual for this tribe; most dikraneurines have the style short and broad with a well developed preapical lobe. The unbranched anal vein of the hind wing is rare among Old World dikraneurines, most of which instead resemble *Dikraneura* in having this vein forked preapically. Most Neotropical dikraneurines have the vein unbranched, but among described Old World dikraneurines, this feature has been reported only in *Kalkiana* Sohi, Viraktamath & Dworakowska, *Motschulskyia* Kirkaldy and *Trifida* Thapa & Sohi.

In having the aedeagus fused to the connective, *Sweta* resembles the bamboo-feeding dikraneurine genera *Anaka*, *Apetiocellata* Sohi and *Trifida*. Among these genera, *Sweta* is somewhat similar to *Anaka* in general habitus in that the body is not depressed as in most other dikraneurines and the orientation of the face is nearly vertical (see Dworakowska and Viraktamath 1975: Figs. 1–3).

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